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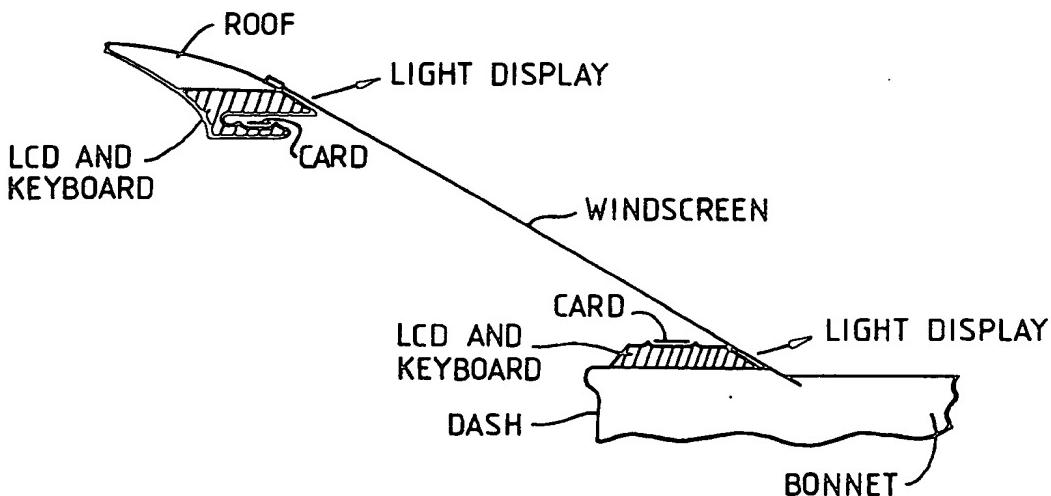
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(54) Vehicle monitoring arrangement

(57) A vehicle monitoring arrangement comprise an in-vehicle unit including one or more visual displays at least one of which is arranged to be visible from outside the vehicle, the unit being cooperable with one or more smart cards to receive and store information in respect of, say, licensing, test certification or other periodically renewable matters relating to the vehicle. The information transferred may also relate to pre-purchased credits for parking or road usage.

Fig.1.

ALTERNATIVE LOCATIONS OF IN-VEHICLE UNIT



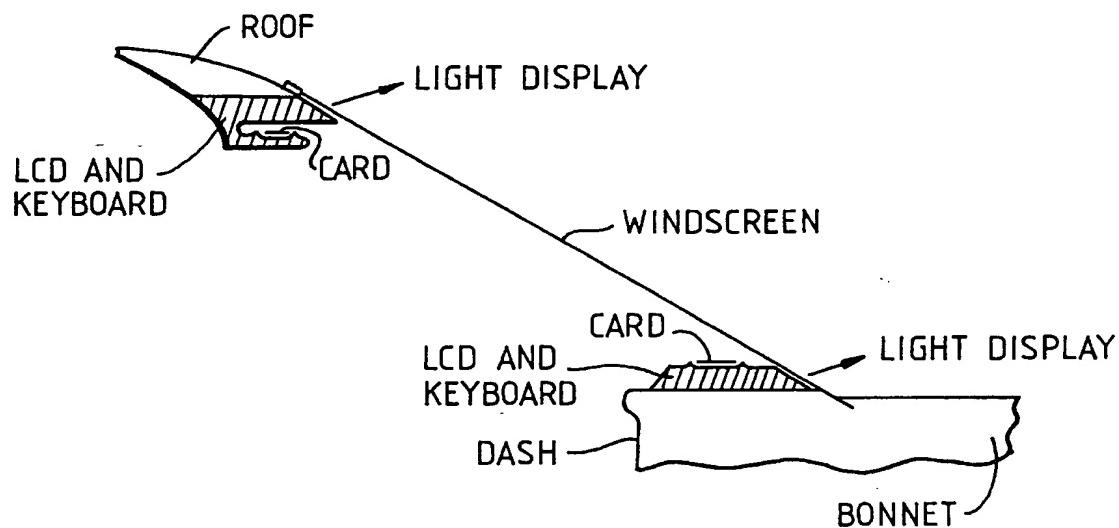
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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1 / 2

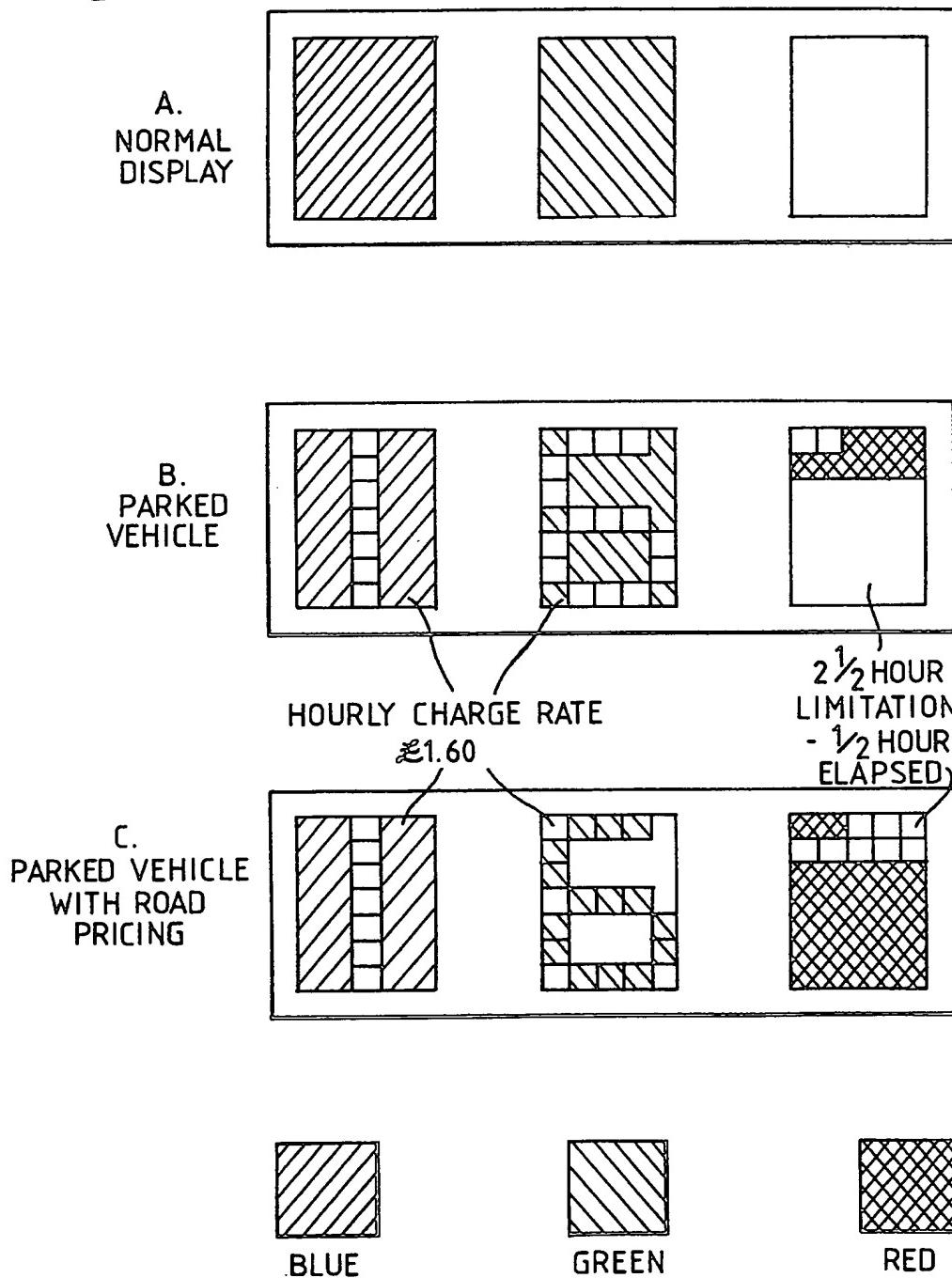
Fig.1.

ALTERNATIVE LOCATIONS OF IN-VEHICLE UNIT



2/2

Fig. 2.



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-1-

Vehicle Monitoring Arrangement

The present invention relates to a vehicle monitoring arrangement, and in particular to a vehicle monitoring arrangement comprising an in-vehicle unit co-operable with one or more smart cards to store information in the unit relating to the respective vehicle.

According to one aspect of the invention a vehicle monitoring arrangement comprises a unit for mounting in a vehicle which unit is co-operable with one or more smart cards for the transfer of information at least from said card or cards to said unit, the unit including means for registering time of day and calendar date, means for registering at least the expiry date of a calendar period in respect of which information may be entered in said unit by means of a or said one smart card, and means on said unit to give an indication of at least some of said information.

According to another aspect of the invention a vehicle monitoring arrangement comprises a unit for mounting in a vehicle which unit is co-operable with one or more smart cards for the transfer of information at least from said card or cards to said unit, the unit including means for registering at least the time of day, means to register elapsed time, and means on said unit to give an indication of said elapsed time.

The information transferred to said unit from said card or

-2-

cards may include credits which are entered in a memory in the unit, and the elapsed time registered in the unit may be arranged to deduct credits from the memory. The elapsed time may be in respect of road usage or in respect of parking time in any zone where parking charges are levied.

Vehicle monitoring arrangements in accordance with the invention will now be described by way of example with reference to the accompanying drawings, of which:-

Figure 1 shows diagrammatically two different locations of an in-vehicle unit in relation to a vehicle windscreen, and

Figure 2 shows different displays on a set of three indicator light panels.

The arrangement comprises an in-vehicle unit which, using its full facilities, increases the effectiveness of collecting vehicle licence fees, monitors MOT test status, guards against uninsured driving, reduces vehicle theft, increases safety, acts as a substitute for parking meters, allows for an audit trail of vehicle servicing and scheduling and provides the essential elements of a road pricing system.

The unit is effectively a time based meter which gives visual reminders via an LCD or similar display to the driver or signals a violation via lights displayed in the windscreen to the enforcement agencies. Alternatively, the violation can be signalled to roadside equipment using the pseudo passive response of the in-vehicle unit. It is in effect the electronic embodiment of all pay and display systems ranging from tax discs to parking tickets.

The working of the unit is best illustrated by consideration of the various applications.

For road fund licencing the meter is used in conjunction with a smart card on which is recorded the revenue paid for a road fund licence and an appropriate expiry date. Further details of the vehicle are recorded on the smart card to make it the electronic equivalent of the vehicle log book. When the smart card is

-3-

presented to the meter to be read, a validity check will first ensure that the card has the unique identity appropriate to the vehicle.

Following this check, the new date of expiry of the licence will be automatically loaded into the meter. Thereafter, the smart card will be kept away from the vehicle as any registration book would be. The clock within the meter would count down the days to the expiry of the licence giving reminders to the driver of impending expiry at intervals leading up to expiry. If at the conclusion of the period, no renewal had been effected, the display lights in the windscreen would persistently oscillate on and off to attract attention to the offence, or a violation signalled to roadside equipment using the pseudo passive response.

In normal circumstances, when a valid road fund licence was in force, the external display lights, which are different colours, will be illuminated variously according to a pseudo random pattern changing from day to day and at differing times of day. However, all meters would be synchronized to give identical displays, changing display format at the same time.

To prevent emulation of the correct display by an illegal meter substitute, a further frequency pseudo random switching pattern would be incorporated.

This latter switching pattern would continue to be displayed when the car was parked with the ignition switched off. Once again, the pseudo random pattern would be common to all meters on a given day.

In summary, there is a static (for approximately 24 hours) display of lights overlaid with a dynamic and frequently recurring switching pattern.

If the pseudo passive response alternative was used, a similar randomised response would be incorporated. In this case, standard encryption techniques could be used with key variables introduced via the roadside interrogation equipment. Both the visual and pseudo passive responses of the In-Vehicle Unit (IVU),

-4-

are a means of making the IVU self supporting from internal batteries. If connection to the vehicle battery was used, normal transponder techniques with an active response could be used in this design i.e. the IVU would have a limited capability and possibly respond on a different frequency.

As an alternative form of payment of road fund licence, a pay-as-you-drive scheme is possible. In this variant a basic rate is charged for time spent in motion on the road causing credits to be progressively deducted from the IVU during driving. The smart card is used to top up credits in the IVU in this application. Differential charge rates are possible according to vehicle classification. The differentiation can be made either in the IVU or on the smartcard.

The current practice of issuing a separate MOT certificate could be replaced by electronic endorsement of the vehicle registration smart card. In a similar way to vehicle licencing the validity date is transferred to the meter by presenting the smart card to the meter. Once again, reminders of imminent expiry are given to the driver via an LCD or similar display and if not renewed the external lights on the meter assume the same persistent oscillation to attract attention to the vehicle. The same pseudo passive or active responses are possible alternatives, where violation indications are triggered following interrogation by roadside equipment. Roadside equipment in this context can be fixed or mounted in mobile detector vans.

For insurance purposes the driver would be required to present his personal smart card to the meter at the start of each journey. Having checked the validity of his insurance for the particular vehicle, the meter will display its normal lights. In default, when either no insured smart card (or the wrong one) is presented, the lights will go into their oscillatory, attention-getting mode. When one journey finishes and another begins will be determined by a pre-set timing delay so that it will not be necessary to re-present the smart card after only a short

-5-

period with the engine switched off. Once again, pseudo passive or active responses are violation detection alternatives.

For vehicle security a further smart card is used in place of the vehicle ignition key. For this application the smart card resides on or in the IVU while the ignition is switched on. The smart card embodies an integrated circuit which forms part of the electronic ignition system. Removal of the smart card thereby removes an essential element of the cars intelligence making it impossible to restart the car by shorting out the meter in the way that a conventional ignition switch can be circumvented.

Since there is a one to one correspondence between the smart card and the meter, the owner of the vehicle can be assured that his vehicle has been secured against the majority of potential thieves.

The same electronic ignition key can, of course, be used to open car doors by presenting the card to or in the proximity of an electronic door lock.

The electronic ignition key smart card can be mounted (see Fig. 1) so that any lateral impact above a prescribed 'g' level causes the smart card to ride out of its location. By careful selection of the shape of the card and its location it is possible to accurately predict the 'g' forces necessary to dislodge the card permanently from its position above/below its position adjacent to the card-reader in the meter. This application clearly calls for a card variant which is not dependent on edge-connectors and is read by a remote coupling eg. inductive. Instant switch off of ignition in a crash situation is desirable to reduce the incidence of fuel related fires.

When used as an alternative to a parking meter system the present arrangement acts as an electronic variant of a pay and display parking system. The smart card is allocated credits in exchange for money at revenue collection points (typically retail outlets). When presented to the meter, these credits are downloaded into the meter from the smart card. The charge rates come

-6-

into force when the driver presses a button on the side of the IVU after the vehicle is stationary. The rate of charging is pre-set by radio beacons surrounding the parking zone. As the vehicle passes a beacon the charge rates appropriate to the zone are downloaded to and stored by the IVU. The facility is thus available to have differential charging rates operable throughout the day, stored in the memory of the IVU. This schedule of charges would be overwritten in the memory of the IVU as the vehicle passes beacons placed at the boundaries between zones.

The driver will set the parking fees and this will be displayed on the front of the meter visible to enforcement agencies through the windscreen (see Fig. 2). In addition, where a parking time limit is in force, the third light acts as an externally visible clock. The driver sets the parking limit and this is displayed on this third light. Once set, an indication of elapsed time is given in the external display. When the elapsed time indication reaches the preset limit, the meter can be arranged to deduct the fixed excess charge.

When the alternate pseudo passive or active system for violation detection is used, the indication that the meter has been set (button pressed) by the driver is either an audible or visible response from the IVU. The number of responses audible or visual gives the duration of the parking i.e. one beep or flash can be taken as durations up to half an hour, 2 responses durations up to 1 hour etc. A driver that has overstayed a parking limitation would be identified by more than the permitted number of responses from the IVU.

Once the driver moves off, the inbuilt motion sensor in the IVU cancels the metering. Hysteresis can be built into the IVU cancellation to prevent immediate reparking or the equivalent of meter feeding.

Parking wardens would carry a small hand-held device either radio or infra-red to successively illuminate vehicles parked kerbside as they passed by.

-7-

If at any time during the parking stay or at the imposition of an excess charge, the funds within the meter are exceeded, all external meter lights oscillate to draw the attention of the enforcement agencies to the vehicle in position or give an invalid response to interrogation by the hand held device of the parking warden who would then impose a penalty fine. Failure to set the meter correctly would attract the same fines as parking by a kerbside meter without putting in money.

The use of a smart card allows vehicle servicing to be scheduled and recorded on the smart card, based on engine hours, derived from elapsed time with ignition on. This is a bonus that derives from the use of the time-based meter.

The present arrangement embodies many of the elements described in Patent Application No. 9118231.1 i.e. Beacons working in transmit only mode delineating zones, IVUs with associated smart card and smart card recharge centres. The violation detection system relies on random observation/interrogation of vehicles. The present arrangement can therefore be used in the road pricing role as well as the above stated roles.

-8-

CLAIMS

1. A vehicle monitoring arrangement comprising a unit for mounting in a vehicle which unit is co-operable with one or more smart cards for the transfer of information at least from said card or cards to said unit, the unit including means for registering time of day and calendar date, means for registering at least the expiry date of a calendar period in respect of which information may be entered in said unit by means of a or said one smart card, and means on said unit to give an indication of at least some of said information.
2. A vehicle monitoring arrangement in accordance with Claim 1 wherein the means to give an indication includes means to give a visual display of information.
3. A vehicle monitoring arrangement in accordance with Claim 1 wherein the means to give an indication includes means to give a visual display of information in response to an interrogation signal received from outside the vehicle.
4. A vehicle monitoring arrangement in accordance with Claim 1 wherein the means to give an indication includes means responsive to an interrogation signal received from road-side equipment to transmit information to said road-side equipment.
5. A vehicle monitoring arrangement in accordance with Claim 3 or Claim 4 wherein said interrogation signal is an infra-red signal.
6. A vehicle monitoring arrangement in accordance with any preceding claim wherein said information transferred to said unit includes information in respect of periods for which the vehicle is licensed or for which a test certificate is valid, and said indication evidences compliance or otherwise with such periods.
7. A vehicle monitoring arrangement in accordance with Claim 1 wherein said unit includes means to receive a contact-less smart card which includes means forming an essential part of an electronic engine or ignition management system of the vehicle in which the unit is mounted.
8. A vehicle monitoring arrangement in accordance with Claim 7 wherein the means to receive the contact-less smart card is arranged

-9-

such that excessive acceleration forces on the vehicle dislodge the smart card and thereby disable the engine or ignition management system.

9. A vehicle monitoring arrangement comprising a unit for mounting in a vehicle which unit is co-operable with one or more smart cards for the transfer of information at least from said card or cards to said unit, the unit including means for registering at least the time of day, means to register elapsed time, and means on said unit to give an indication of said elapsed time.

10. A vehicle monitoring arrangement in accordance with Claim 9 wherein the information transferred to said unit from said card or cards includes credits which are entered in a memory in the unit, and the elapsed time registered in the unit is arranged to deduct credits from the memory.

11. A vehicle monitoring arrangement in accordance with Claim 9 or Claim 10 wherein there are provided means to give an indication of compliance or otherwise with a preset time period.

12. A vehicle monitoring arrangement in accordance with Claim 11 wherein said time period is preset by the user of the vehicle.

13. A vehicle monitoring arrangement substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977**Examiner's report to the Comptroller under
Section 17 (The Search Report)**

- 10 -

Application number
9207498.8**Relevant Technical fields**

- | | | |
|----------------------|-----|--|
| (i) UK CI (Edition | K) | G4M(MAA,MAW), G4Q(QCB,QCE,QCF,
QCJ), G4T(TAF) |
| (ii) Int CL (Edition | 5) | G06K, G07C, G08G |

Search Examiner**Databases (see over)**

- (i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search**Documents considered relevant following a search in respect of claims**

1 TO 8

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	US 4982072 (TAKIGAMI) See column 2, line 13 - column 4, line 63	1,6,7

-II-

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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